

Remarks

Reconsideration and reexamination of the above-identified patent application, as amended, are respectfully requested. Claims 1-15 are pending in this application upon entry of this Amendment. In this Amendment, the Applicant has amended claims 1-3 and 7-8. No claims have been cancelled or added in this Amendment. Of the pending claims, claims 1-2 and 7-8 are the only independent claims.

Claim Rejections – 35 U.S.C. § 112

In the Office Action mailed March 22, 2005, the Examiner rejected claims 1-6 under 35 U.S.C. § 112, 2nd paragraph, as being indefinite. The Examiner indicated that in claims 1-3 “sulfate” has crystal water but in “dry state” is unclear. The Examiner questioned whether the sulfate be called “in hydrate state” because it has crystal water.

In response, the Applicant has amended claims 1-3 to address the Examiner’s 35 U.S.C. § 112, 2nd paragraph, concerns. Accordingly, the Applicant respectfully requests reconsideration and withdrawal of the rejection to claims 1-3 under 35 U.S.C. § 112, 2nd paragraph.

Claim Rejections - 35 U.S.C. § 103

The Examiner rejected claims 1-2, 6-8, and 11 under 35 U.S.C. § 103(a) as being unpatentable over JP 53119724 (“JP ‘724”) in view of U.S. Patent No. 4,820,345 issued to Berg et al. (“Berg”). The Applicant respectfully traverses this rejection and believes that the claimed invention as set forth in independent claims 1-2 and 7-8 is patentable under 35 U.S.C. § 103(a) over JP ‘724 in view of Berg.

1. The Claimed Invention

A feature of the claimed invention is to increase the strength of a water-soluble casting mold by adjusting an inorganic sulfate compound contained in a water-soluble binder to be in a state of hydrate containing crystal water after the casting mold has been dried.

2. JP '724

The Applicant has noted the relevance of JP '724 in the Background Art section of the Applicant's specification (see page 2, lines 13-19; and page 3, lines 5-16 of the Applicant's specification). As noted in the Applicant's specification, JP '724 discloses a technique of using magnesium sulfate as a binder for a refractory granular material for casting sand and mixing the refractory granular material with magnesium sulfate and water, thereafter forcibly drying the obtained mixture at a temperature of 200° to 300°C to obtain a mold (see page 2, lines 13-19 of the Applicant's specification). However, with respect to the mold disclosed by JP '724, since magnesium sulfate hydrate is dehydrated at a temperature of 200°C or higher, the magnesium sulfate in the obtained mold is supposed to be an anhydride. Magnesium sulfate in the anhydride state has a rather decreased strength as compared with that in hydrate state containing crystal water. Therefore, in order to retain a sufficient strength of the mold, the additional amount of magnesium sulfate has to be increased which is significantly disadvantageous in terms of moldability of the mold, easiness of drying, and recovery of the binder. As a result, the working efficiency decreases. (See page 3, lines 5-16 of the Applicant's specification.)

Accordingly, JP '724 does not teach or suggest the novel feature provided by the claimed invention of increasing the strength of a water-soluble casting mold by adjusting an inorganic sulfate compound contained in a water-soluble binder to be in a state of hydrate containing crystal water after the casting mold has been dried.

3. Berg

Berg concerns a water and fire resistant building material which belongs to a different technical field from that of the claimed invention. Berg discloses using magnesium chloride or magnesium sulfate as part of the binder composition of the building material, and forming a magnesium cement hydrate storing water in the form of crystalline water (see col. 2, lines 59-68 of Berg). Berg also discloses that the magnesium cement gives off water over a wide temperature range in high temperatures of a fire, and, in this way, acts to limit the temperature and to smother the fire (see col. 3, lines 1-7 of Berg).

Accordingly, JP '724 does not teach or suggest the novel feature provided by the claimed invention of increasing the strength of a water-soluble casting mold by adjusting an inorganic sulfate compound contained in a water-soluble binder to be in a state of hydrate containing crystal water after the casting mold has been dried.

4. The Claimed Invention Compared to JP '724 and Berg

Neither JP '724 nor Berg, alone or in combination, teach or suggest the novel feature provided by the claimed invention of increasing the strength of a water-soluble casting mold by adjusting an inorganic sulfate compound contained in a water-soluble binder to be in a state of hydrate containing crystal water after the casting mold has been dried.

Further, as indicated above, Berg discloses a magnesium cement hydrate storing water in the form of crystalline water which is to improve fire resistance of the building material. However, Berg does not refer to a water-soluble binder for a casting mold. As a result, it is difficult for one having ordinary skill in the art to reach the idea of combining the teachings of JP '724 with the teachings Berg as JP '724 and Berg belong to quite different technical fields.

Thus, the claimed invention as recited in independent claims 1-2 and 7-8 are not obvious to one having ordinary skill in the art in view of JP '724 and Berg. Claims 6 and 11 depend from independent claims 1 and 7, respectively, and include the limitations therein. Accordingly, the Applicant respectfully requests reconsideration and withdrawal of the rejection to claims 1-2, 6-8, and 11 under 35 U.S.C. § 103(a) over JP '724 in view of Berg.

5. Dependent Claim Rejections under 35 U.S.C. § 103(a)

A. Claim 3

The Examiner rejected claim 3 under 35 U.S.C. § 103(a) as being unpatentable over JP '724 in view of Berg and further in view of U.S. Patent No. 5,281,242 issued to Sadan ("Sadan"). Sadan is directed to a method for recovering magnesium sulfate products from a mixture of epsomite and halite. Sadan discloses that the resulting monohydrate magnesium sulfate product is particularly useful as desiccant because the material can absorb up to 100% of its weight in water without caking (see col. 6, lines 15-18 of Sadan.)

However, Sadan does not teach or suggest to use monohydrate magnesium sulfate as a water-soluble binder for a casting mold, and does not teach or suggest the technical idea of increasing the strength of a water-soluble casting mold by using monohydrate magnesium sulfate as a water-soluble binder for the casting mold.

Therefore, claim 3, which depends from independent claim 2, is not obvious to one of ordinary skill in the art in view of the combination of JP '724, Berg, and Sadan.

B. Claims 4-5 and 9-10

The Examiner rejected claims 4-5 and 9-10 under 35 U.S.C. § 103(a) as being unpatentable over JP '724 in view of Berg and further in view of U.S. Patent No. 4,423,764 issued to Seeney et al. ("Seeney"). Seeney discloses using aluminum dihydrogen phosphate

and potassium polyphosphate for binders and hardeners of casting molds (see col. 1, lines 33-43 of Seeney.)

However, Seeney does not teach or suggest the technical idea of making the inorganic sulfate compound exist in a state of hydrate containing crystal water after the drying, and, thereby increasing the strength of a water-soluble casting mold. Also, Seeney does not teach or suggest using various phosphate compounds together with an inorganic sulfate compound so as to retain the water-solubility of the mold and improve the heat resistance. Furthermore, it is to be noted that aluminum dihydrogen phosphate has no effect in enhancing the heat resistance of a water-soluble casting mold, even if it is combined, with magnesium sulfate heptahydrate.

Therefore, claims 4-5 which depend from independent claim 1 and claims 9-10 which depend from independent claim 7 are not obvious to one of ordinary skill in the art in view of the combination of JP '724, Berg, and Seeney.

C. Claims 12 and 14

The Examiner rejected claims 12 and 14 under 35 U.S.C. § 103(a) as being unpatentable over JP '724 in view of Berg and further in view of JP 63132745 ("JP '745"). JP '745 is directed to a method for producing a water-soluble casting mold. In this method, the slurry is prepared by adding water to a mixture containing the gypsum, phlogopite, hydrate of MgSO_4 and refractories. The slurry is poured into a mold and is molded under pressure, thereby, a molding having a shape of the casting mold is obtained. After the molding is subjected to the primary drying at a temperature equal or lower than 120°C , the molding is subjected to the secondary drying at a temperature equal or higher than 200°C .

Regarding the secondary drying, JP '745 discloses that it is conducted at a temperature equal or higher than 200°C , so as not to remain crystal water by causing a dehydration reaction in the gypsum ($\text{MgSO}_4 \cdot 1/\text{H}_2\text{O} \rightarrow \text{MgSO}_4 + 1/\text{H}_2\text{O}$). That is, the

microwave heating in the secondary drying is to heat the molding so as to achieve the above-mentioned purpose, therefore, the heating duration is rather long (5 minutes) as disclosed in the preferred embodiment.

As explained, the microwave heating of the secondary drying in JP '745 is not to make the inorganic sulfate compound exist in a state of hydrate containing crystal water after the drying. In other words, JP '745 discloses the microwave heating only as one of heating means for drying molding.

Therefore, claims 12 and 14 which depend from claims 7 and 8, respectively, are not obvious to one of ordinary skill in the art in view of the combination of JP '724, Berg, and JP '745.

D. Claims 13 and 15

The Examiner rejected claims 13 and 15 under 35 U.S.C. § 103(a) as being unpatentable over JP '724 in view of Berg and further in view of U.S. Patent No. 4,761,264 issued to Nishio et al. ("Nishio"). Nishio is directed to a method for molding powders by using a cold isostatic press method. In this method, a thin-wall resilient mold is introduced inside a ventilative mold support. Thereafter, the outside pressure of the ventilative mold support is reduced to less than atmospheric pressure, thereby, the thin-wall resilient mold is put exactly close to the inside wall of the ventilative mold support. Powder material is then supplied into the thin-wall resilient mold. That is, in the method of Nishio, the function of the ventilative mold support is to make the thin-wall resilient mold put exactly close to the inside wall thereof by forming a vacuum inside the ventilative mold support.

In the claimed invention, as recited by claims 13 and 15, a ventilative ceramic mold which is to be filled with the casting sand is used to release the evaporated water evenly to the outside from the ceramic mold at the time of drying the casting sand. Thereby, unevenness of crystal water contained in the inorganic sulfate compound is restrained so that

the strength of the manufactured mold can be made uniform. As explained, the function of the ventilative ceramic mold in the claimed invention is quite different from that of the ventilative mold support disclosed by Nishio. Therefore, claims 13 and 15 which depend from claims 7 and 8, respectively, are not obvious to one of ordinary skill in the art in view of the combination of JP '724, Berg, and Nishio.

CONCLUSION

In summary, claims 1-15, as amended, meet the substantive requirements for patentability. The case is in appropriate condition for allowance. Accordingly, such action is respectfully requested.

If a telephone or video conference would expedite allowance or resolve any further questions, such a conference is invited at the convenience of the Examiner.

Respectfully submitted,

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Date: June 21, 2002

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